Portion 1 of the Farm N'Rougas Zuid No 121, Kenhardt 7/9,

STRAUSSHEIM SOLAR PV POWER PROJECTS

TRAFFIC IMPACT ASSESSMENT

MAY 2016

KMA CONSULTING ENGINEERS

Project: 7051.02

PO Box 25054, Langenhoven Park, 9330, 12 AG Visser Street, Langenhoven Park, Bloemfontein
Tel & Fax: 051 446 2647, Cell: 083 381 5884, E-mail: kma@telkomsa.net

REPORT SHEET

Property Description:	*Portion 1 of the Farm N'Rougas Zuid No 121, Kenhardt***.**
Municipal Area:	*ZF Mgcawu District Municipality*
Application:	
Type of Report:	*Traffic Impact Assessment*
Project Number:	*7051.02*
Declaration	*I, Koot Marais, author of this study, hereby certify that I am a professional traffic engineer (registration No 920023) and that I have the required experience and training in the field of traffic and transportation engineering as required by the Engineering Council of South Africa (ECSA), to compile traffic impact studies and I take full responsibility for the content, including all calculations, conclusions and recommendations made herein.*
Compiled By:	*Koot Marais Pr Eng*
Signed:	
Date:	*May 2016*

PREPARED BY:

`

TABLE OF CONTENTS

`

1 INTRODUCTION

1.1 Aim of the Study

The aim of this study was to assess the traffic impact of the planned **Straussheim Solar Projects** on **Portion 1 of the Farm N'Rougas Zuid No 121, Kenhardt.** The projects consist of the following:

- AMDA Alpha,
- AMDA Bravo, and
- AMDA Charlie

1.2 Background

Although related, the purpose of the study was twofold, namely:

- As required with any change in land use, information must be provided to the relevant authorities and in particular the road authorities on the possible impact of the development on the functioning of the road network. If aspects of the impact are unacceptable, recommendations should be made as to how this should be addressed.

- The Department of Environmental Affairs also requires the compilation of a traffic management plan for the site that should focus on the site access road/s to ensure that no hazards would result from the increased truck traffic and the traffic flow would not be adversely impacted. This Plan must include measures to minimise impacts on local commuters e.g. limiting construction vehicles travelling on public roadways during the morning and late afternoon commute time and avoid using roads through densely populated built-up areas so as to not to disturb existing retail and commercial operations.

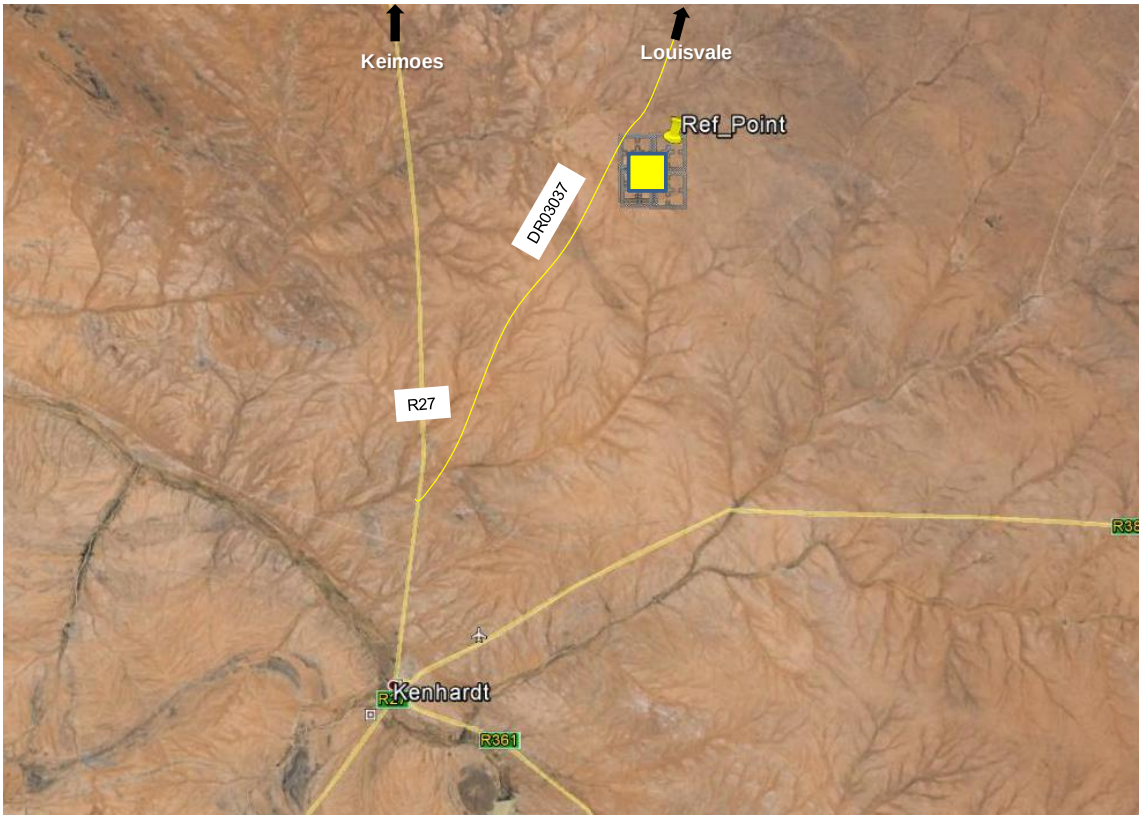
In practical terms this requires the determination of the traffic impact of the planned development and the recommendation of mitigating factors should the impact be unacceptable. As a result, this study was in principle based on the *Manual for Traffic Impact Studies*[1]*;* although considering the nature of the development, not all aspects of a standard traffic impact study have to be considered.

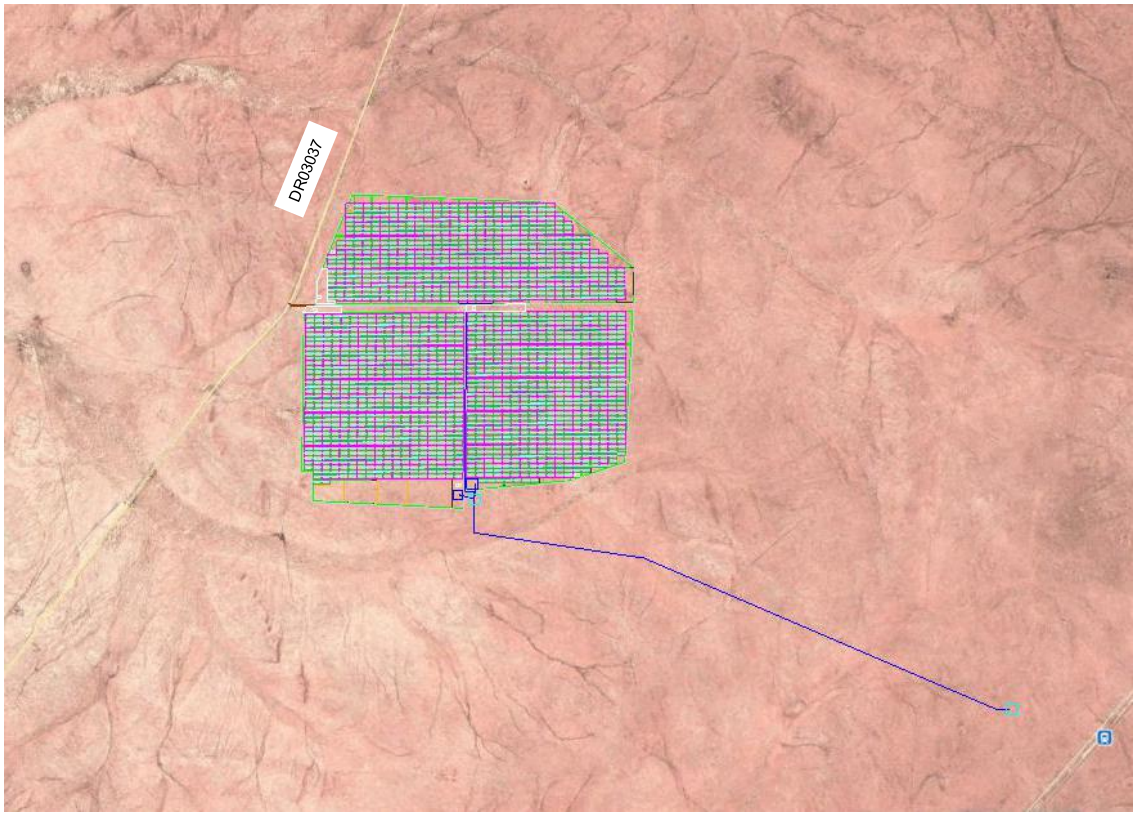
This document reports on the findings of the study.

`

1.3 Site Location

The location of the development is shown in Figures 1.1 and 1.2. The site is located to the north east of Kenhardt, and to the east of the DR03037 District Road.





Figures 1.1 & 1.2 Location Plans

The development area is also shown in the photo below.

Photo 1: Development site as seen from the DR03037

1.4 Development

AMDA Developments plan on developing the AMDA Alpha; - Bravo and -Charlie 75MW solar PV power plants at the Straussheim site to the northeast of Kenhardt in the Northern Cape and is in the process of securing the development rights, consents and authorisations necessary to bid the project in the Department of Energy's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP).

The developments under consideration are 75MW Photovoltaic (PV) solar facilities with a maximum generation capacity of 75MW (megawatts) AC (Alternating Current). The facilities will probably consist of fixed or single-axis tracking PV panel arrays, which will convert solar energy from the sun (Direct-Current DC = >90MW) into electricity (Alternating-Current AC = 75MW).

The electricity from the PV power plant will be evacuated via a 132kV overhead line to the new collector sub-station on the site and from there to the Eskom grid at their Nieuwehoop sub-station The connection point for the evacuation line will be determined by the Eskom grid connection requirements and the line will be designed and built to Eskom's standards.

The density of development is highest for fixed rack systems and lowest if two axis trackers are used. Typically fixed rack systems would take up about 2 to 3 ha/MW and a PV plant using trackers would need about 4.5 to 6 ha/MW. The current trend in the highly competitive REIPPPP market implies that either fixed structures or horizontal single axis tracking systems will most likely be used. On average, a 75MW plant should require approximately 225Ha.

1.5 Scope of Analysis

The site was visited and traffic operations and road conditions were observed on 24 and 25 May 2015.

`

2 BACKGROUND INFORMATION

2.1 Existing Road Network

The most important roads in the area are the following:

a) R27

The R27 is a provincial route that consists of two disjointed segments. The first segment connects Cape Town with Velddrif along the West Coast. The second runs from Vredendal via Vanrhynsdorp, Calvinia, Brandvlei and Kenhardt to Keimoes on the N14 near Upington. Originally the R27 designation continued beyond Upington all the way to Pretoria, but this section became part of the N14 and various other roads.

.

Photo 2: R27 between Upington and Kenhardt

`

b) DR03037 Kenhardt - Louisvale District Road

This gravel road links the R359 at Louisvale with the R27 near Kenhardt. The road is a gravel road.

Photo 3: DR03037 between Louisvale and Kenhardt

2.2 Road Planning

There is no known road planning that will directly affect the development.

3 TRIP GENERATION & CAPACITY CONSIDERATIONS

The developments can broadly be categorised as industrial types of developments, but cannot from a trip generation point of view be regarded as a typical industrial development. Industrial developments are in general relatively labour intensive with people working at the facility, and products being transported to and from the site. In this instance the facilities will mostly function unattended and the only trips generated during the operating phase will be security and maintenance trips, which are expected to be limited.

The main trip generation will be during the initiation of the project when the site is prepared, but especially during the construction period, which is expected to have a duration of 15 to 18 months.

Owing to the relatively open or expansive nature of the PV plant and hence the construction process, no specific service roads are envisaged. The site will be sufficiently cleared to allow access for the excavation equipment and the rough terrain vehicles that will deliver the site assembled PV rack or trackers structures to their positions.

Vegetative ground cover reduces dust which influences the PV panel efficiency. The re-growth of the ground cover or rehabilitation is therefore important to the PV plant. It thus makes sense to minimise the disruption of the existing vegetative ground cover and minimise the stripping and site clearing, and rather cut the vegetation down to between 200 – 300mm.

The portions of the site needed will be cleared, grubbed and graded by means of the necessary cuts and fills in order to condition the terrain to the maximum slopes allowed for buildings, roads and racks. Given the flat nature of the site there is very little cut and fill envisaged.

Trip generation during construction is difficult to accurately estimate as it depends on the tempo of construction and types - and size of vehicles used to transport materials. It is however expected that during the construction phase the traffic will peak at approximately 10 large delivery vehicles and 40 to 50 concrete trucks per day while the footings are being cast and then drop to about 20 to 30 large delivery vehicles per day while the electrical reticulation is being installed and the trackers are being erected.

Importantly, construction of a Solar PV facility does not require abnormal load vehicles during the construction or operational phases. The materials all fit on standard interlink vehicles or in standard containers and the concrete gets delivered in ready-mix type vehicles.

Considering the low traffic volumes on the DR03037, no capacity problems are expected as a result of the construction vehicles and no road improvements are required based on capacity considerations.

The operational phase includes all operations needed to be carried out to maintain the PV power plant in a full operational mode producing as much electricity as possible and feeding it into the Eskom distribution network.

As an example, but not limited to, the following activities occur during the operational phase:

- Checking and verifying of the electricity production
- Maintaining and monitoring a weather station
- Routine inspection of all equipment and systems
- Periodic maintenance
- Periodic cleaning of PV modules
- 24hour security operations

`

In a case where there are multiple sites in close proximity, the manager, key technical and administrative staff is located at one of the sites and each site has general workers, technicians, electricians and security. It is expected that there will be a team of 5 or 6 people employed at each project and a further common team of about 10 people based at one of the sites. Permanent 24hour security with two or three shifts per day will be provided.

In total, it is expected that there will be approximately 25 people permanently employed at the three sites combined during the operational phase with an additional PV module cleaning team of ±15 people spending approximately two months at each site cleaning the modules. Modules should get cleaned twice a year.

There will be no residential or overnight accommodation on the site.

In summary it is expected that on average the traffic generated by the PV plant during the operation phase will be in the order of five to ten vehicles per day.

As traffic volumes on the District Road are low, the impact of these trips will obviously be negligible

`

4 ACCESS

As the DR03037 traverses the property, a number of access options are possible.

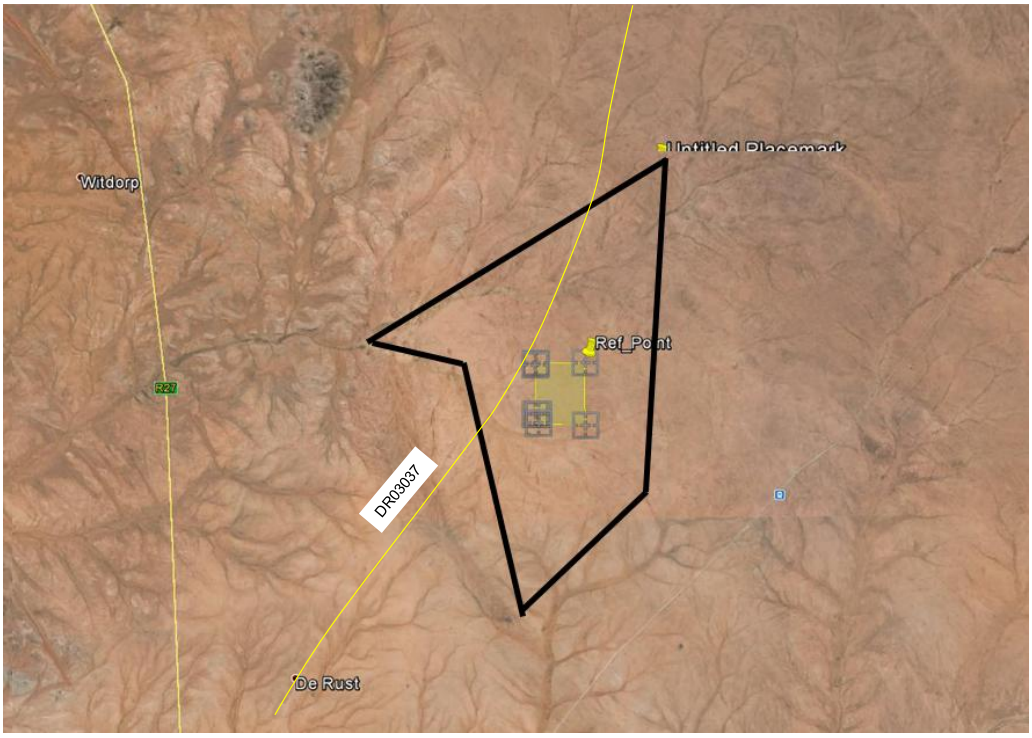


Figure 4.1 Farm Location Relative to Road

The most obvious options will be to either use the existing farm access, shown as Position A in the figure below, or a new access in a position where the access road length will be at a minimum (Position B).The two positions are shown below.

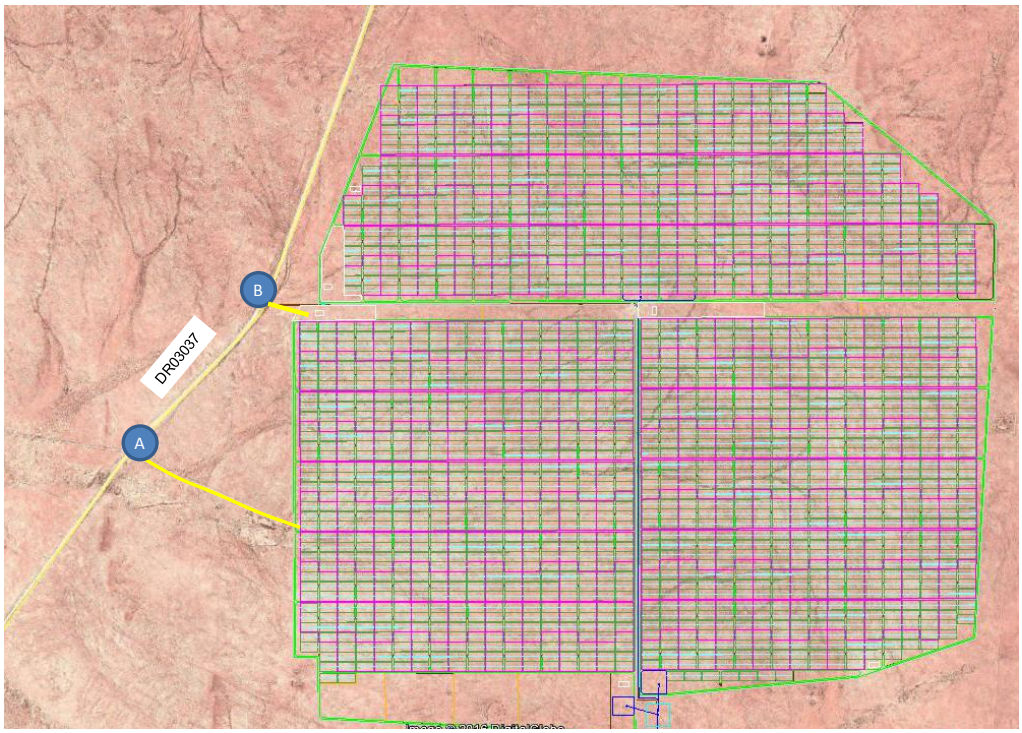


Figure 4.2 Possible Accesses

4.1 Access at Position A

The existing farm access is shown below.

Photo 4: Existing farm access

`

4.1.1 Location and Spacing of Access

The spacing along this section is shown below.

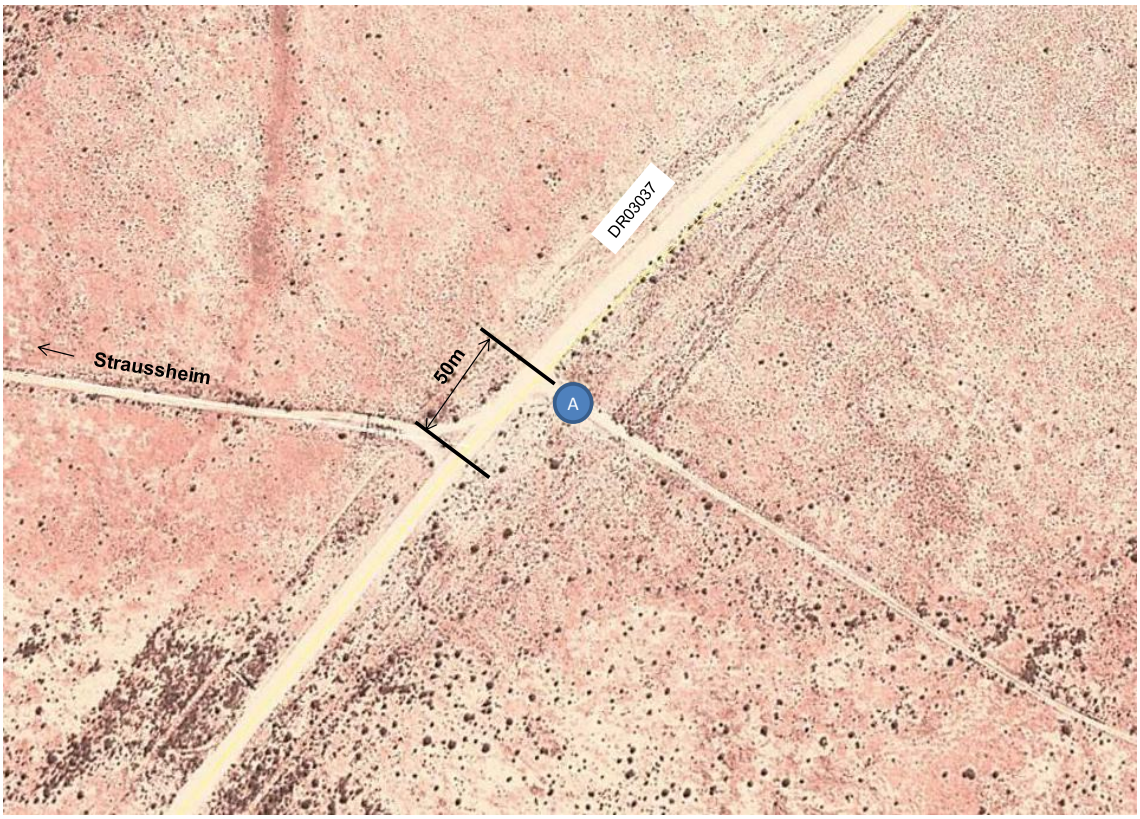


Figure 4.3 Proposed Access Relative to other Accesses

As shown, the farm access is located close to another access, resulting in a staggered intersection. Access spacing is therefore not really acceptable and thus not recommended. The spacing can be rectified by relocating the access to a position opposite the other access. Another factor is also that the access road will be considerably longer than an access road at Position B.

4.2 Access at Position B

The most appropriate position for access is where the length of the access road will be minimised as shown below.

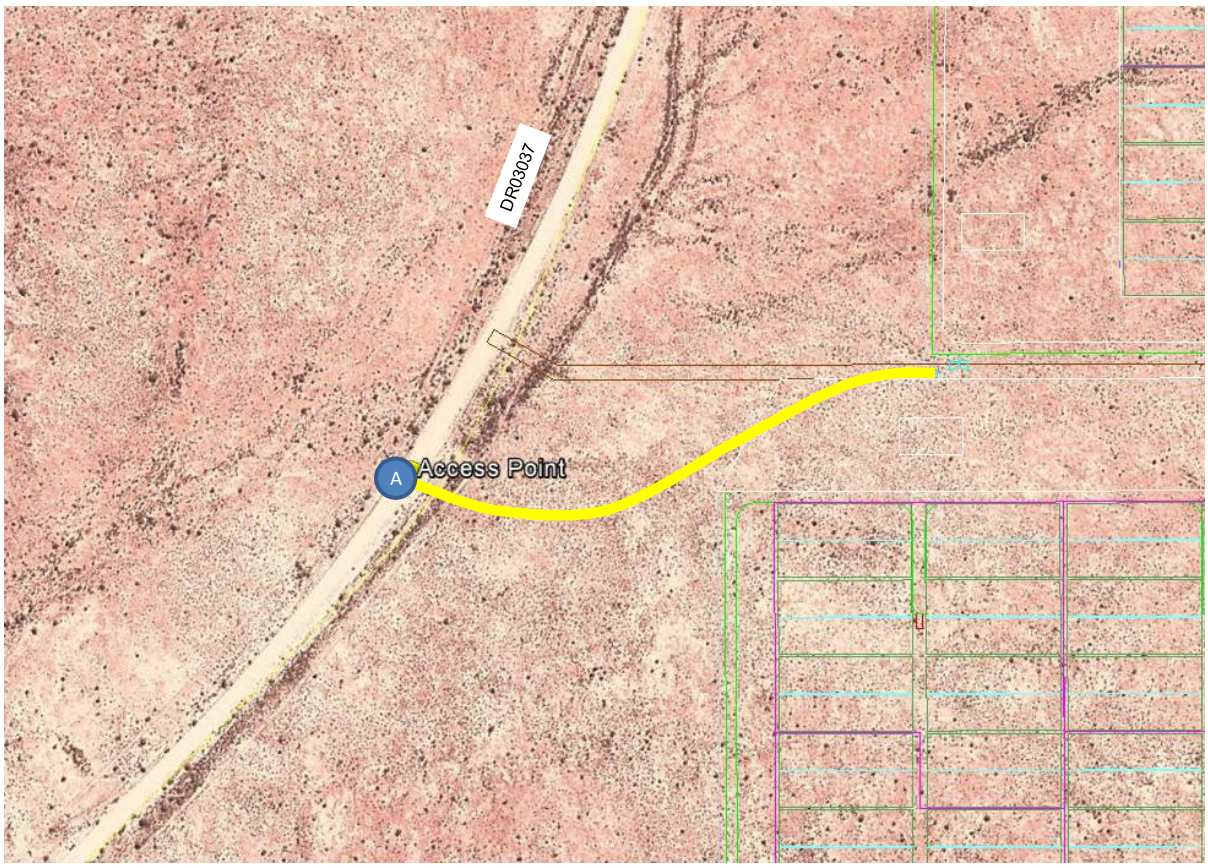


Figure 4.4 Recommended Access Position

Apart from the shorter access road, the advantages of this position are that there are no other accesses in the area and the access will be located on the outside of a horizontal curve.

As shown in the figure above provision is made in the layout for access in this area. Although sight distances should be acceptable in this position, actual measurements shown that due to the nature of the curve, the position of the access point is important. The best sight distances will be obtained at the following position:

S 29°07'01.7"
E -21°16'14.3"

This position is slightly to the south of the proposed position according to the layout.

The access position is shown below.

Photo 5: Proposed access position

4.2.1 Road Classification

To determine the appropriate access spacing, road classification needs to be determined. The *TRH 26 South African Road Classification and Access Management Manual* [10] uses a six-class rural and urban road classification system. The first three classes in the system consist of mobility roads while the second three classes are used for access/activity roads or streets

A distinction is made between rural and urban areas. Roads in rural and urban areas have the same six functional classes but at different scales and standards. Rural roads have longer reaches of connectivity and therefore require higher levels of mobility than urban roads. It is therefore necessary that the classification system should differentiate between rural and urban areas.

Rural Classes		**Urban Classes**	
R1	Rural principal arterial*	U1	Urban principal arterial
R2	Rural major arterial*	U2	Urban major arterial
R3	Rural minor arterial*	U3	Urban minor arterial
R4	Rural collector road	U4	Urban collector street
R5	Rural local road	U5	Urban local street
R6	Rural walkway	U6	Urban Walkway

Based on the Manual the road can be classified as a R4 Rural collector road. The Manual describes a Class R4 rural collector as follows:

These roads form the link to local destinations. They do not carry through traffic but only traffic with an origin or destination along or near the road. A collector road must never be quicker to use to pass through an area than the alternative mobility road.

These roads would typically give access to smaller rural settlements, tourist areas, mines, game and nature parks and heritage sites. The roads can also provide direct access to large

farms. Collector roads can also be provided within larger rural settlements to provide a collector function in such settlements.

The length of these roads would mostly be shorter than 10 km. Traffic volumes should not be more than about 1 000 vehicles per day

Rural minor arterials carry inter-district traffic between:

- *Small towns, villages and larger rural settlements (population typically less than about 25 000);*
- *Smaller commercial areas and transport nodes of local importance that generate relatively high volumes of freight and other traffic in the district (public transport and freight terminals, railway sidings, small seaports and landing strips);*
- *Very small or minor border posts;*
- *Tourist destinations;*
- *Other Class 1, 2 and 3 routes.*
- *Smaller centres than the above when travel distances are relatively long (longer than 50 to 100 km).*

The typical length of these routes would vary between about 10 km and 100 km. These roads are not busy and traffic volumes between 100 and 2 000 per day are typical. Class R3 arterials are not always continuous, often stopping when a particular destination is reached, although they could also serve more than one node in a district and can cross into adjoining districts

4.2.2 Location and Spacing of Access

The Guidelines provides the following minimum access separation:

Table 6.5: Recommended minimum access separations

Design speed (km/h)	Upstream access class	
	Unsignalised marginal	All other access types
40	20	80
50	35	110
60	50	130
70	70	175
80	100	200
100	170	300
120	250	350

With no other accesses in the area, spacing is acceptable.

4.2.3 Sight Distances

Stopping sight distance should at least at all times be maintained. This is the distance required to enable a driver to observe an obstruction, and stop in time.

Ideally adequate intersection sight distance must be provided at accesses to allow drivers to find a sufficiently large gap in the traffic stream to enter the road safely and with limited disruption to the traffic on the main road.

The *National Guidelines* prescribe the following as far as shoulder sight distance. (Gap Acceptance Sight Distance) is concerned:

TABLE 7.3: MINIMUM GAP ACCEPTANCE SIGHT DISTANCE (METRES)								
Vehicle type	**Eye height**	**Design speed**						
		40 km/h	**50 km/h**	**60 km/h**	**70 km/h**	**80 km/h**	**100 km/h**	**120 km/h**
Stop and yield control, 7.5m wide main road (X = 5m)								
Passenger cars	1.05m	80	100	120	140	160	200	240
Single unit	1.80m	120	150	180	210	240	300	360
Single unit & trailer	1.80m	150	190	225	265	305	380	455
Stop and yield control 22.5m wide main road (X = 5m)								
Passenger cars	1.05m	100	125	150	175	200	250	300
Single unit	1.80m	135	170	200	235	270	335	405
Single unit & trailer	1.80m	165	205	250	290	330	415	495
Yield control (X = 20m)								
Passenger cars	1.05m	65	80	95	110	125	155	190
Single unit	1.80m	75	95	115	135	150	190	230
Single unit & trailer	1.80m	95	115	140	165	185	235	280

Gap acceptance sight distances measured from the eye height to an object height of 1.30m.

Based on the speed limit of 100km/h and main road width of 7.5m and considering the fact that trucks will use the access, sight distances of 380m should preferably be available. In this instance sight distances exceed this value with no restrictions as shown below.

Photo 6: Sight distance to the south

Photo 7: Sight distance to the north

4.2.4 Access Layout

Given the nature of the District Road it is not necessary to construct a major access. In principle the access should be developed with a proper gravel bell mouth.

It is essential that the access intersects with main road at an angle of not less than 70^0.

`

4.3 Summary

In summary access is proposed at Position B and specifically at the following coordinates:

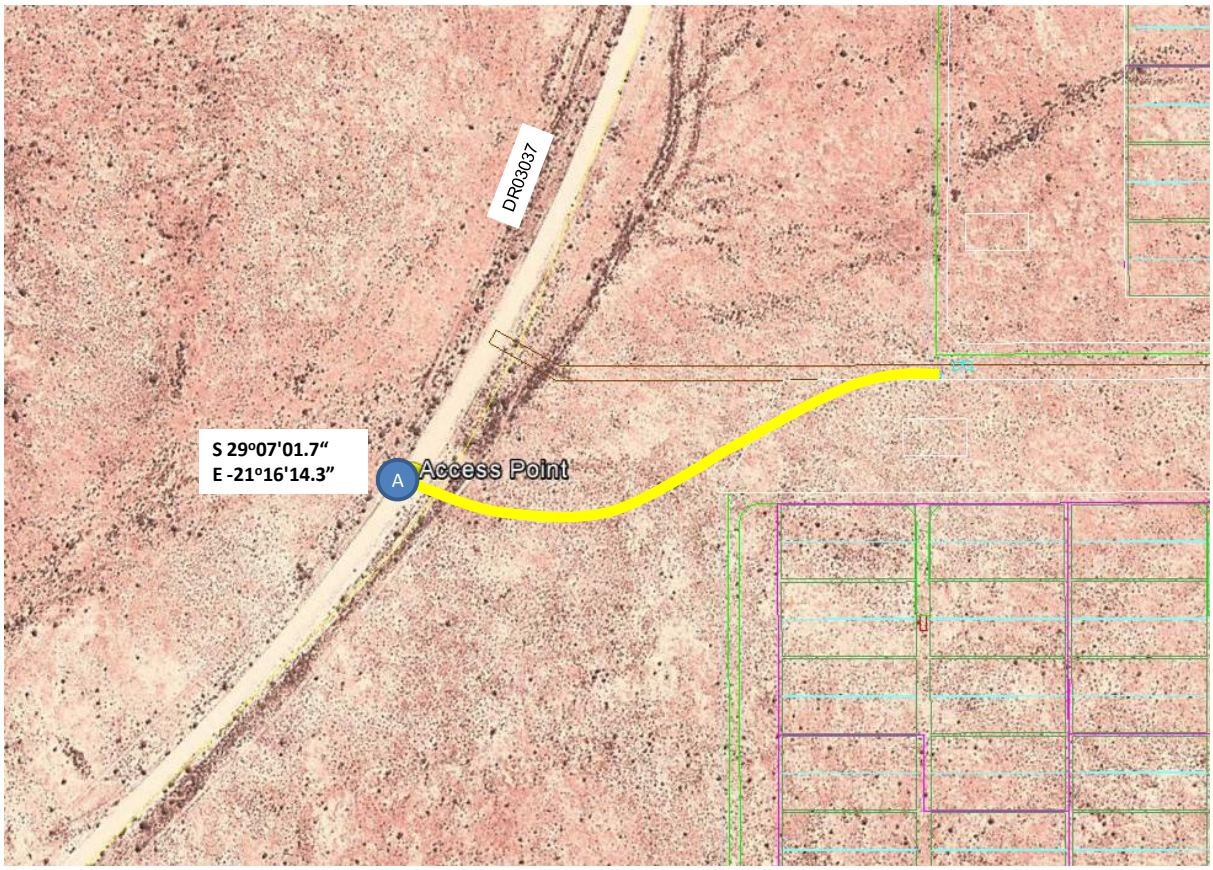


Figure 4.5 Recommended Access Position

5 INTERNAL ROADS

Internal roads will be planned depending on the actual layout. The roads must be able to accommodate heavy vehicles, and should also not result in excessive dust.

The access - and internal roads will be constructed with surfacing that will minimise dust. It is planned to provide access roads with a width of 6m and internal roads that are 3m wide, with wide, open side drains forming part of the drainage system. Internal roads serving heavy vehicles should ideally be 7.5m wide, with the result that passing bays will be provided at strategic points on the access road to make provision for trucks travelling in opposite directions. This is only likely to occur during the construction phase.

The roads will be built with a minimum of 400mm depth of sub-grade preparation and an aggregate base layer of up to150mm thick compacted to the 95% Proctor (AASHTO). The base layer will either be of material obtained from the excavations on site or aggregate from a commercial source.

The road layout will be designed in order to ensure ease of access to every rack or tracker structure and the horizontal geometry will be designed to enable the turning of trucks and construction vehicles.

Sufficient space will be allowed at the access points to ensure that the vehicles do not queue up on to the public roads while being processed through security.

During the operational phase access around the site is generally only required for security and routine inspection. Access for cleaning operations or maintenance is very infrequent

`

6 EXTERNAL ROUTES

Equipment and materials can possibly be transported to the site from either Upington or Kenhardt.

6.1 Possible Routes

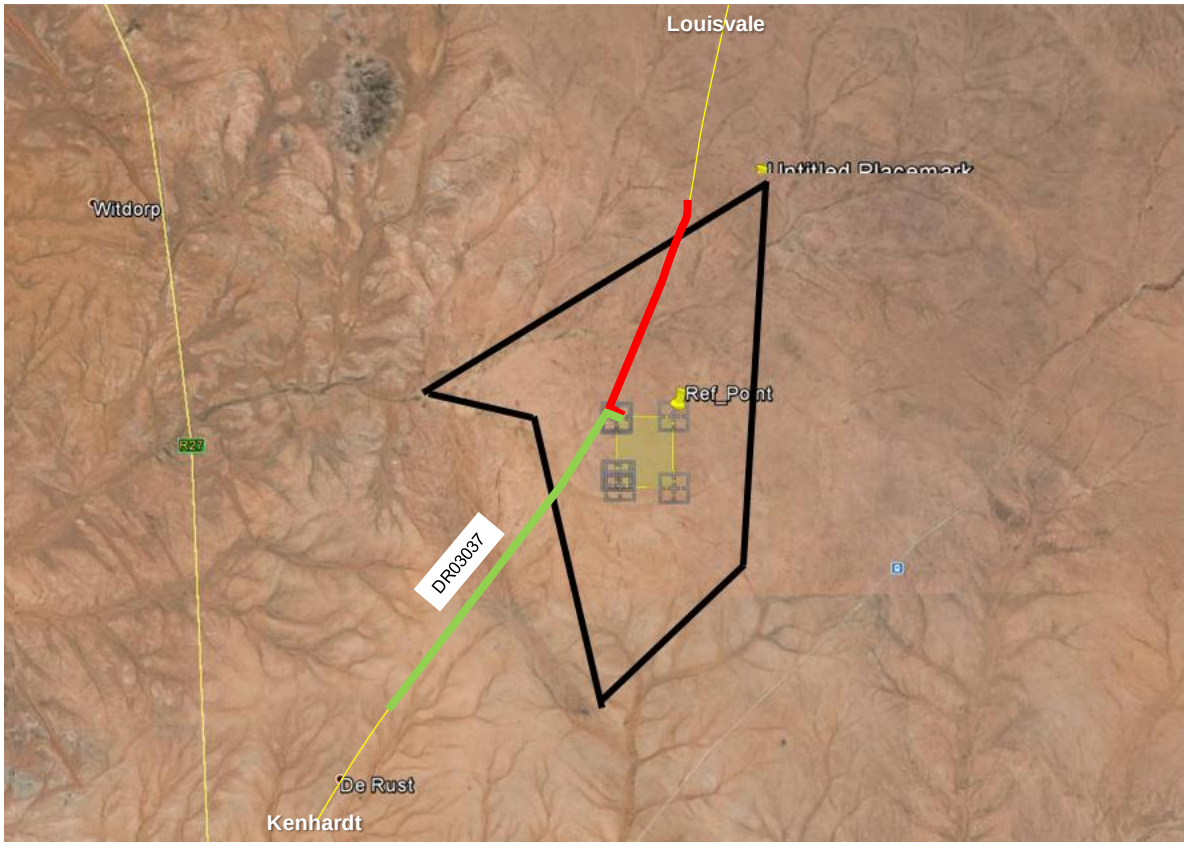


Figure 6.1 Possible External Routes

Given the shorter distance to a paved road, the most likely route would be to and from Kenhardt

No communities will be affected, with Kenhardt the nearest community (30km)

Photo 8: Kenhardt as approached from the North

The DR03037 is in a relatively good condition

Photo 9: Good condition of DR03037

`

7. CONCLUSIONS AND RECOMMENDATIONS

a) The development is not expected to generate significant trips, although there will be an increase in traffic, especially in heavy vehicle traffic, during the construction period.

b) No road improvements are required from a capacity point of view.

c) Additional traffic as a result of the development is not expected to have a significant impact on communities in the area.

d) The recommended access position is from the DR03037 at coordinates:

S 29°07'01.7"
E -21°16'14.3".

In summary, it is believed that from a traffic point of view, the intended development will not have a significant impact on the area, and in particular on communities in the area. The exact location of the access is nonetheless important.

`

7 REFERENCES

1. **Manual for Traffic Impact Studies,** Department of Transport, Pretoria, 1995
2. **South African Trip Generation Rates,** Department of Transport, Pretoria, 1995
3. **ITE Trip Generation Rates, 6th Edition,** Institute of Transportation Engineers, Washington, 1998
4. **Transportation and Land Development,** Institute of Transportation Engineers, Washington, 1988
5. **UTG 1, Guidelines for the Geometric Design of Urban Arterial Roads,** CSIR, Pretoria, 1986
6. **National Guidelines for Road Management in South Africa**, COTO
7. **Spacing of Accesses on Major Arterials,** Department of Transport, Pretoria, 1993
8. **UTG 7, Guidelines for the Geometric Design of Urban Local Residential Streets,** CSIR, Pretoria, 1989
9. **SANRAL Geometric Design Guidelines,** SANRAL, 2004
10. **TRH 26, South African Road Classification and Access Management Manual, Version 1.0,** COTO, 2012
11. **Bethlehem Truck Stop Business Plan**, Du Plessis 7 Associates, Potchefstroom, 2013

`